

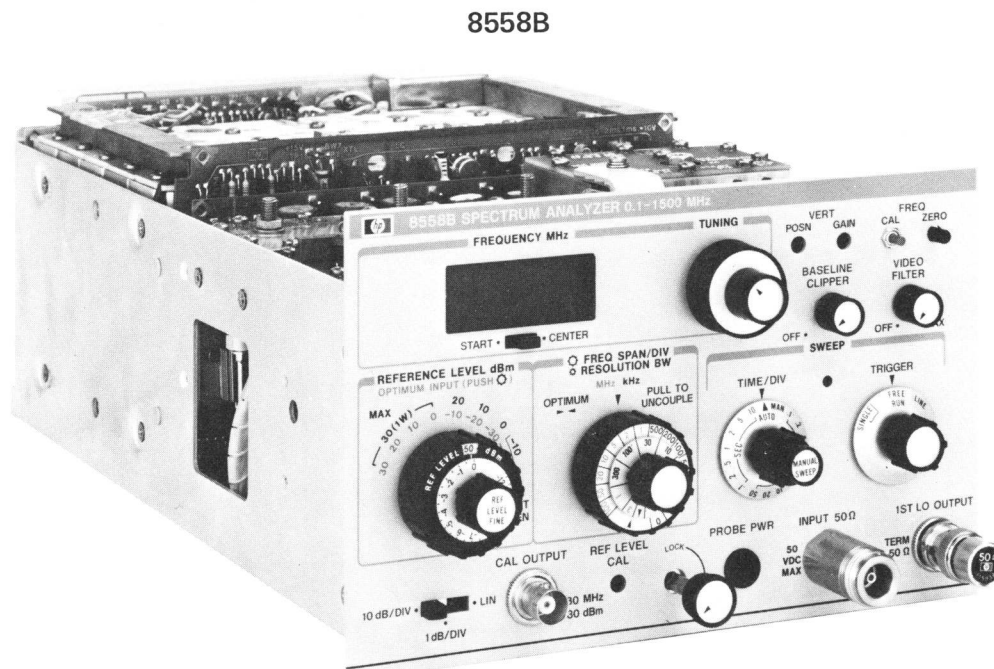
OPERATING INFORMATION

8558B SPECTRUM ANALYZER 0.1—1500 MHz

DUPLICATE OF SECTIONS 1 THRU 3
OF YOUR OPERATING AND SERVICE MANUAL
KEEP WITH INSTRUMENT

APRIL 1979

HEWLETT  PACKARD



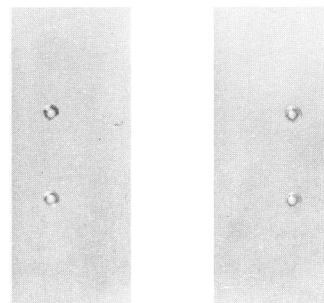
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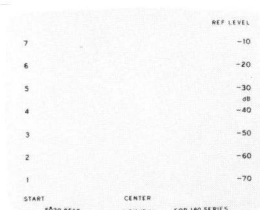
**TERMINATION
11593A**



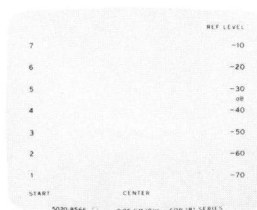
**SIDE STOP KIT
08558-60131**



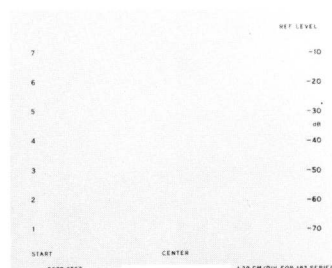
**SPECTRUM ANALYZER OVERLAY KIT
5060-0319**



5020-8565



5020-8566



5020-8567

Figure 1-1. Model 8558B Spectrum Analyzer 0.1 – 1500 MHz and Accessories

SECTION I GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This manual contains all information required to install, operate, test, adjust, and service the Hewlett-Packard Model 8558B Spectrum Analyzer 0.1–1500 MHz, hereafter referred to as the Spectrum Analyzer. Figure 1-1 shows the Spectrum Analyzer and accessories supplied. For information concerning related equipment, such as the Hewlett-Packard Model 180-series Oscilloscope Mainframes, refer to the appropriate manual or manuals.

1-3. This manual is divided into eight sections which provide information as follows:

a. SECTION I, GENERAL INFORMATION, contains the instrument description and specifications as well as the accessory and recommended test equipment list.

b. SECTION II, INSTALLATION, contains information relative to receiving inspection, preparation for use, mounting, packing, and shipping.

c. SECTION III, OPERATION, contains operating instructions for the instrument.

d. SECTION IV, PERFORMANCE TESTS, contains information required to verify that instrument performance is in accordance with published specifications. This section also contains an Abbreviated Performance Test to verify that the spectrum analyzer is operating properly without testing all the specifications listed in Table 1-1.

e. SECTION V, ADJUSTMENTS, contains information required to properly adjust and align the instrument after repair.

f. SECTION VI, REPLACEABLE PARTS, contains information required to order all parts and assemblies or to effect exchange of assemblies.

g. SECTION VII, MANUAL BACK-DATING CHANGES, contains backdating information to make this manual compatible with earlier equipment configurations.

h. SECTION VIII, SERVICE, contains descriptions of the circuits, schematic diagrams, parts location diagrams, and troubleshooting procedures to aid the user in maintaining the instrument.

1-4. Packaged with this manual is an Operating Information Supplement. This supplement should stay with the instrument for use by the operator.

1-5. On the title page of this manual, below the manual part number, is a "Microfiche" part number. This number may be used to order 4 x 6-inch microfiche transparencies of the manual. Each microfiche contains up to 60 photo-duplicates of the manual pages. The microfiche package also includes the latest Manual Change supplement as well as all pertinent Service Notes.

1-6. Where text changes are required to reflect Options 001 and 002, these changes are shown in italic type immediately following the applicable text. Users of the standard Spectrum Analyzer should ignore all text material in italic type. Notes are also included in tables and illustrations where users of Options 001 and 002 need to be informed of differences from the standard instrument.

1-7. SPECIFICATIONS

1-8. Specifications for the instrument are listed in Table 1-1. These are the performance standards or limits against which the instrument is tested. A list of typical operating characteristics is provided in Table 1-2. They are included as additional information only; they are not specifications.

1-9. SAFETY CONSIDERATIONS

1-10. General

1-11. This instrument has been designed and tested according to international Safety Requirements. To ensure safe operation and to keep the instrument safe, the information, cautions, and warnings in this manual must be heeded.

Table 1-1. Model 8558B Spectrum Analyzer/180-Series Display Specifications (1 of 2)

SPECIFICATIONS

FREQUENCY

ACCURACY:

Frequency Range: 100 kHz to 1500 MHz.

Frequency Display Span (on a 10-division CRT horizontal axis):

14 calibrated spans from 5 kHz/div to 100 MHz/div in a 1, 2, 5 sequence. In "0" the analyzer is a fixed-tuned receiver.

Accuracy: Frequency error between any two points on the display is less than $\pm 5\%$ of the indicated frequency separation.

Digital Frequency Readout:

Indicates center frequency or start frequency of the frequency display span. Two ranges: 0 to greater than 195 MHz with 100 kHz resolution; 195 MHz to 1500 MHz with 1 MHz resolution. FREQ ZERO control allows frequency readout to be adjusted for accurate calibration anywhere in the frequency range; FREQ CAL control removes frequency hysteresis.

Accuracy (after zeroing on the LO feedthrough and operation of the CAL button, 10° to 40°C):

0–195 MHz: ± 1 MHz $\pm 20\%$ of FREQUENCY SPAN PER DIVISION setting.

195–1500 MHz: ± 5 MHz $\pm 20\%$ of FREQUENCY SPAN PER DIVISION setting.

RESOLUTION:

Stability:

Residual FM: Less than 1 kHz peak-to-peak for time ≤ 0.1 sec.

Noise Sidebands: More than 65 dB below CW signal, 50 kHz or more away from signal with a 1 kHz resolution bandwidth and full video filtering.

Resolution:

Bandwidth Ranges: 3 dB resolution of 1 kHz to 3 MHz in a 1, 3, 10 sequence. Resolution bandwidth may be coupled to frequency display span at a ratio of two display spans per resolution bandwidth.

Resolution Bandwidth Accuracy: Individual resolution bandwidth 3 dB points calibrated to $\pm 20\%$ (10° to 40°C).

Resolution Bandwidth Selectivity: 60 dB/3 dB resolution bandwidth ratio $< 15:1$.

Video Filter: (Post-detection filter) used to average displayed noise. Bandwidth variable from approximately 3X Resolution Bandwidth to approximately 0.01X Resolution Bandwidth. In the MAX position the video filter provides noise averaging with a bandwidth of approximately 1.5 Hz.

AMPLITUDE

RANGE:

Measurement (Absolute):

–117 dBm to +30 dBm.

315 nV to 7.07V

001: –110 dBm to +30 dBm.

002: –63 dBmV to +80 dBmV.

Reference Level Range:

–112 dBm to +60 dBm (+30 dBm is maximum input level).

002: –62 dBmV to +110 dBmV (+80 dBmV is maximum input level)

Display Range:

Log: 70 dB with 10 dB/DIV and 8 dB with 1 dB/DIV
Linear: Scale factor is equal to Reference Level (converted to volts) divided by 8 divisions.

Reference Level remains constant as scale factor (10 dB/DIV, 1 dB/DIV, LIN) is changed.

Dynamic Range:

Average Noise Level: < -107 dBm with a 10 kHz resolution bandwidth (0 dB input attenuation) (1–1500 MHz).

001: < -100 dBm.

002: < -53 dBmV.

Spurious Responses: For input signal level $\leq$ Optimum Input Level setting, all image and out-of-band mixing responses, harmonic and inter-modulation distortion products are more than 70 dB below input signal level, 5–1500 MHz; 60 dB below, 100 kHz to 5 MHz.

Table 1-1. Model 8558B Spectrum Analyzer/180-Series Display Specifications (2 of 2)

Spurious Responses Due to Third Order Intermodulation Distortion: For two input signals 10 dB above Optimum Input Level Setting¹, third order intermodulation distortion products are > 70 dB below input signals. 5–1500 MHz: 60 dB below, 100 kHz to 5 MHz (signal separation $\geq$ 50 kHz).

Residual Responses (no signal present at input):
 < -100 dBm with 0 dB input attenuation (1 MHz through 1500 MHz).

001: < -95 dBm.

002: < -50 dBmV.

ACCURACY:

Amplitude Accuracy:

Frequency Response (Flatness): ± 1.0 dB.

Switching Between Bandwidths (at 10° to 40°C):

3 MHz to 300 kHz: ± 0.5 dB.

3 MHz to 1 kHz: ± 1.0 dB².

Reference Level Accuracy (at fixed center frequency, fixed resolution bandwidth):

± 1.5 dB (includes input attenuator and IF gain accuracy. May be improved using IF or RF substitution techniques).

Amplitude Log Display: ± 0.1 dB/dB but not more than ± 1.5 dB over full 70 dB display range.

Calibrator:

Amplitude: -30 dBm ± 1 dB.

002: +20 dBmV ± 1.0 dB.

Frequency: 280 MHz ± 50 kHz, crystal controlled.

INPUT

Connector: Type N female.

001 and 002: 75 Ω BNC female.

Impedance: 50 Ω nominal.

001 and 002: 75 Ω nominal.

Attenuator: 70 dB range.

Accuracy ± 0.5 dB per 10 dB step but not more than ± 1.0 dB over full 70 dB range.

Maximum Input Levels:

AC or Peak: Peak or average power +10 dBm (1.0V ac peak) incident on mixer (0 dB input attenuation). +30 dBm (10V ac peak or 1W) incident on input attenuator. (MAX input markings on front panel indicate maximum input allowable for < 1 dB gain compression or attenuator overload.)

002: Peak or average power +63 dBmV (1.0V ac peak) incident on mixer; +80 dBmV (14V ac peak or 1.3W) incident on input attenuator.

DC: ± 50 Vdc.

GENERAL

Power Requirements (including oscilloscope display):

115 or 230 volts $\pm 10\%$. 48 to 440 Hz less than 200 VA. Convection-cooled.

Weight:

Model 8558B Spectrum Analyzer:

Net, 5,9 kg (13 lb).

Shipping, 6,8 kg (15 lb).

Model 182T Display (formerly 182C, Option 807):

Net, 12,0 kg (26-1/2 lb).

Shipping, 16,1 kg (35-1/2 lb).

Model 181T Display (formerly 181A, Option 807):

Net, 11,1 kg (24-1/2 lb).

Shipping, 15,2 kg (33-1/2 lb).

Model 181TR Display (formerly 181AR, Opt. 807):

Net, 11,8 kg (26 lb).

Shipping, 16,6 kg (36-1/2 lb).

Model 180TR Display (formerly 180D, Option 807):

Net, 11,4 kg (25 lb).

Shipping 16,1 kg (35-1/2 lb).

Dimensions:

Model 182T Display:

338, 1 mm high (including height of feet and top handle) x 201,6 mm wide x 498,5 mm deep (13-5/16 x 7-15/16 x 19-5/8 in).

Model 181T Display:

364,75 mm high (including height of feet and top handle) x 200 mm wide x 530 mm deep (12 x 7-7/8 x 21-1/4 in).

Model 180TR/181TR Display:

132,6 mm high (including height of feet) x 425 mm wide x 543 mm deep (5-7/32 x 16-3/4 x 21-3/8 in).

¹Corresponds to two -30 dBm signals incident on input mixer.

²100 kHz bandwidth limited to 80% R.H. At 95% R.H., 40°C, switching uncertainty is ± 2.5 dB.

Table 1-2. Model 8558B/180-Series Supplemental Performance Characteristics (1 of 4)

PERFORMANCE CHARACTERISTICS

FREQUENCY

Center Frequency Zero:

Adjusts digital center frequency readout. **FREQ ZERO** control may be used at 0 frequency or any other frequency up to 1500 MHz to calibrate the center frequency reading of the Spectrum Analyzer.

Center Frequency Cal:

Reduces hysteresis in center frequency readout. **FREQ CAL** button should be pushed whenever the center frequency is changed more than 50 MHz, in order to maintain accuracy of center frequency readout.

Out-of Range Blanking:

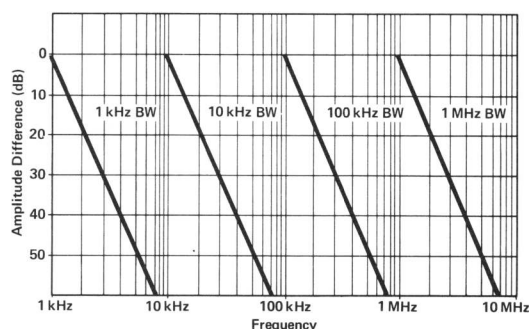
CRT display is automatically blanked whenever the Spectrum Analyzer is swept or tuned approximately 50 MHz below 0 frequency or above 1600 MHz.

Long-Term Drift:

At Fixed center frequency, after 2-hour warm-up:
50 kHz/10 min.

Temperature Drift: 200 kHz/°C.**Resolution:**

The following illustration shows typical Spectrum Analyzer resolution for different IF bandwidths.



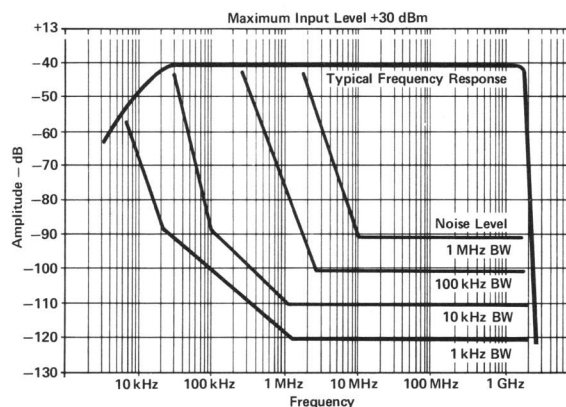
Typical Spectrum Analyzer Resolution

AMPLITUDE

Frequency Response and Sensitivity:

Typical curves of Spectrum Analyzer sensitivity and frequency response versus input frequency are shown in the following illustration.

001 and 002: See graphs at end of table.



Average Noise Level vs. Input Frequency

Gain Compression:

For Signal Levels below MAX INPUT level setting, gain compression is less than 1 dB.

Distortion:

The following curves illustrate typical harmonic and third order intermodulation distortion.

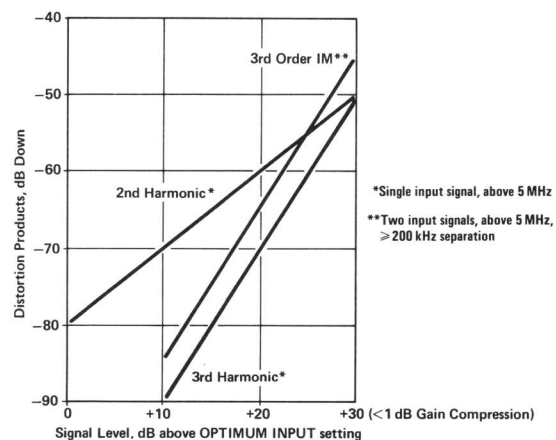


Table 1-2. Model 8558B/180-Series Supplemental Performance Characteristics (2 of 4)

OUTPUT**LO Output:**

+10 dBm nominal, 50 ohms: 2.05–3.55 GHz.

Cal Output:

–30 dBm, 280 MHz with 2nd through 5th harmonics greater than –60 dBm.

002: +20 dBmV, 280 MHz with 2nd through 5th harmonics greater than –10 dBmV.

Horizontal Output:

(AUX D on oscilloscope display rear panel.)
–5.0 to +5.0V for 10 div CRT deflection, 5 k Ω output impedance.

Vertical Output:

(AUX A on oscilloscope display rear panel.) 0 to 0.8V for 8-division deflection on CRT 50 Ω output impedance.

Pen Lift/Blanking Output:

(AUX B on oscilloscope display rear panel.) 0 to 15V (0V pen down). Approximately 10 k Ω impedance when blanked. Compatible with HP 7004B, 70034B, 7005B, and 7035B X-Y RECORDERS.

21.4 MHz IF Output:

A 21.4 MHz output linearly related to the RF input to the analyzer. Bandwidth controlled by analyzer Resolution Bandwidth setting. Amplitude controlled by input attenuator, IF gain vernier, and first six IF step gain positions (–10 through –60 dBm Log Ref with 0 dB input attenuation). Output is approximately –10 dBm for full-scale signals on the CRT. (AUX C on oscilloscope display rear panel, 50 Ω output impedance.)¹

002: (+40 through –10 dBmV Log Ref with 0 dB input attenuation. Output approximately –10 dBm for full scale signals.

NOTE

Oscilloscope display rear panel outputs refer to 180-T Series and other 180-series displays with Opt 807. For oscilloscope mainframes without Opt 807, see Performance Characteristics under GENERAL.

Probe Power:

+15V, –12.6V: 150 mA max.

Powers 1120A, 1121A, 1123A, or 1124A high impedance probes.

SWEEP**Sweep Time:**

Auto: Sweep time is automatically controlled by Frequency Span, Resolution Bandwidth and Video Filter.

Manual: Sweep determined by front panel control; continuously variable across CRT in either direction.

Calibrated Sweep Times: 16 internal sweep times from 0.1 ms/div to 10 sec/div in a 1, 2, 5 sequence. For sweep times of 2 ms/div to 10 sec/div, the Spectrum Analyzer is operable in its normal swept frequency mode. Faster sweeps are useful for analyzing modulation waveforms when the Spectrum Analyzer is being operated as a fixed-tuned receiver with 0 Display span. Sweep times may be reduced to an effective 10 μ sec/div by using the 180-series X10 horizontal magnifier.

Accuracy: $\pm 10\%$.

DISPLAY**Oscilloscope Display Sections:**

180-Series Compatibility: The 8558B is compatible with all 180A, 180AR, 180C, 180D, 180F, 181A, 181AR, 182C, 184A and 184B mainframes. It is operable with the 183A, 183B mainframes, but the display is limited to 6 divisions by the 6 division CRT.

180T-Series: The following 180T-series oscilloscope displays provide four nonbuffered rear panel auxiliary outputs (for unattenuated vertical, horizontal, and penlift outputs) and P39 medium persistence CRT phosphor (except with 181T and 181TR, which provide variable persistence):

180TR P39 phosphor

181T P31 phosphor with variable persistence

181TR P31 phosphor with variable persistence

182T P39 phosphor

¹For the following serial prefixes only. (Earlier Option 807 mainframes must be modified by adding a 200 pF capacitor across A7R3.) 180C, >1315A; 180D, >1314A, 181A, >1313A; 181AR, >1315A; 182A, >1311A.

Table 1-2. Model 8558B/180-Series Supplemental Performance Characteristics (3 of 4)

See Hp Service Notes 180A/AR-10, 180C/D-2, 181A/AR-8, 182A/C-1, or 184A/B-1 for information needed to modify standard display (those without Opt. 807) to provide auxiliary outputs.

The following oscilloscope displays are recommended with the 8558B:

Large Screen (Model 182T; formerly 182C, Option 807):

Plug-ins: Accepts Model 8558B Spectrum Analyzer and Model 8755A Swept Amplitude Analyzer.

Cathode Ray Tube:

Type: Post-accelerator, 19 kV accelerating potential; aluminized P39 phosphor.

Graticule: 8 x 10 div internal graticule, 1 div = 1.29 cm. 5 subdivisions per major division.

Rack Mount (Model 180TR; formerly 180D, Option 807):

Plug-ins: Same as 182T.

Cathode Ray Tube:

Type: Post-accelerator, 15 kV accelerating potential; aluminized P39 phosphor.

Graticule: 8 x 10 div internal graticule, 1 div = 1 cm. 5 subdivisions per major division.

Variable Persistence/Storage (Model 181T/181TR; formerly 181A, Option 807):

Plug-ins: Accepts Model 8558B Spectrum Analyzer, Model 8755A Swept Amplitude Analyzer, and 1800 Series time domain plug-ins.

Cathode Ray Tube:

Type: Post accelerator storage tube; 8.5 kV accelerating potential; aluminized P31 phosphor.

Graticule: 8 x 10 div internal graticule 1 div = 0.95 cm. 5 subdivisions per major division.

Persistence:

Normal: Natural persistence of P31 phosphor (approx. 40 μ s).

Variable: From < 0.2 s to > 1 min.

Storage Time:

Store Mode: > 1 hr at reduced intensity.

View Mode: > 1 min at normal intensity.

Functions Used With Time Domain Plug-ins Only:
Intensity modulation calibrator, beam finder.

GENERAL

CRT Baseline Clipper: Front panel control adjusts blanking of CRT trace baseline to allow more detailed analysis of low-repetition-rate signals and improved photographic records to be made.

EMI: Meets or exceeds MIL-I-6181D.

Temperature Range:

Operating: 0°C to +55°C.

Storage: -40°C to +75°C.

Input Reflection Coefficient: < 0.20 (1.5 SWR) for all Optimum Input Level settings except -40 dBm (0 dB input attenuation).

001 and 002: < 0.20 (1.5 SWR) at all Optimum Input Level Settings.

8558B in Other Than 180T-Series or Option 807 Mainframes:

The 8558B Spectrum Analyzer will operate with all 180A, 180AR, 180C, 180D, 181A, 181AR, 182A, 182C, 184A, and 184B mainframes. If the Oscilloscope mainframe does not have Option 807, only the horizontal, vertical and blanking outputs will be available at the mainframe rear panel. These outputs will be attenuated and shifted in dc level:

Table 1-2. Model 8558B/180-Series Supplemental Performance Characteristics (4 of 4)

Horizontal Output (MAIN SWEEP OUTPUT on oscilloscope mainframe rear panel): Approximately -1.5V to $+0.2\text{V}$ with a load greater than 600 ohms. Output impedance <100 ohms.

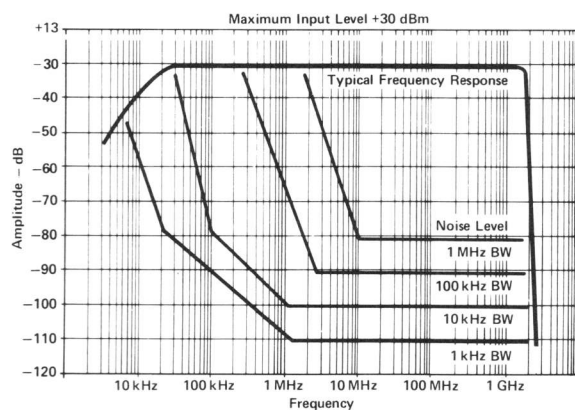
Vertical Output (MAIN GATE OUTPUT on oscilloscope mainframe rear panel): Approximately $+0.7\text{V}$ to $+1.0\text{V}$ with a load greater than 600 ohms. Output impedance <100 ohms.

Blanking Output (DELAYED GATE OUTPUT on oscilloscope mainframe rear panel): Approx-

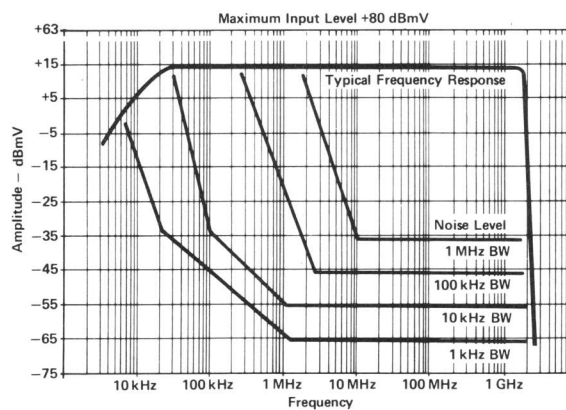
imately $+0.7\text{V}$ to $+3.1\text{V}$ (0.7V unblanked) with a load greater than 1500 ohms. Output impedance <100 ohms.

CAUTION

Do not connect X-Y recorder to 180-series DELAYED GATE OUTPUT or damage to the oscilloscope mainframe will result.



Average noise level vs. input frequency
(Option 001)



Average noise level vs. input frequency
(Option 002)

1-12. Operation

1-13. BEFORE APPLYING POWER, refer to SAFETY CONSIDERATIONS in Section I of the Operating and Service Manual for the Mainframe.

1-14. Service

1-15. Although the instrument has been designed in accordance with international safety standards, the information, cautions, and warnings in this manual must be followed to ensure safe operation and to keep the instrument safe. Service and adjustments should be performed only by qualified service personnel.

1-16. Adjustment or repair of the opened instrument with the ac power connected should be avoided as much as possible, and when inevitable, should be performed only by a skilled person who knows the hazard involved.

1-17. Capacitors inside the instrument may still be charged even though the instrument has been disconnected from its source of supply.

1-18. Whenever it is likely that the protection has been impaired, make the instrument inoperative and secure it against any unintended operation.

WARNINGS

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal is likely to make this instrument dangerous.

Servicing this instrument often requires that work be done with the protective covers removed and with ac power connected. Be very careful; the energy at many points in the instrument may, if contacted, cause personal injury.

CAUTION

BEFORE SWITCHING ON THIS INSTRUMENT, make sure that all ac line-powered devices connected to the instrument are connected to the protective earth ground.

1-19. INSTRUMENTS COVERED BY MANUAL

1-20. This instrument has a two-part serial number. The first four digits and the letter comprise

the serial number prefix. The last five digits form the sequential suffix that is unique to each instrument. The contents of this manual apply directly to instruments having the same serial number prefix(es) as listed under SERIAL NUMBERS on the title page.

1-21. An instrument manufactured after the printing of this manual may have a serial prefix that is not listed on the title page. This unlisted serial prefix indicates that the instrument is different from those documented in this manual. The manual for this instrument is supplied with a yellow Manual Changes supplement that contains "change information" that documents the differences.

1-22. In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is keyed to this manual's print date and part number, both of which appear on the title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-23. For information concerning a serial number prefix not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-24. DESCRIPTION

1-25. The Model 8558B displays the amplitude and frequency of each component of an input signal on a CRT. This display gives quantitative information often not available from a conventional oscilloscope. The Model 8558B is capable of measuring signals from +30 dBm to -117 dBm over a frequency range of 0.1 MHz to 1500 MHz.

001: +30 dBm to -110 dBm.

002: +80 dBmV to -63 dBmV.

The complete measuring system includes the Model 8558B Spectrum Analyzer plugged into a Hewlett-Packard 180-series Oscilloscope mainframe.

1-26. The Model 8558B is designed for simplicity of operation. Most measurements are made using only three controls, two for frequency and one for amplitude. The CENTER or START frequency of the display is shown on the front-panel LED readout.

1-27. OPTIONS

1-28. 8558B Option 001

1-29. *The Model 8558B Option 001 provides Spectrum Analyzer with a direct measurement capability in a 75 ohm system. The front-panel INPUT is a 75 ohm BNC connector. The Option 001 provides calibration in dBm from -110 dBm to +30 dBm in 10 steps. Manual changes to incorporate this option are given in italics following applicable text references and as necessary in tables and illustrations.*

1-30. 8558B Option 002

1-31. *The Model 8558B Option 002 provides the Spectrum Analyzer with a direct measurement capability in a 75 ohm system. The front-panel INPUT is a 75 ohm BNC connector. The Option 002 provides calibration in dBmV from -63 dBmV to +80 dBmV in 10 dB steps. Manual changes to incorporate this option are given in italics following applicable text references and as necessary in tables and illustrations.*

1-32. 8558B Option 910

1-33. *Option 910 provides additional Operating and Service manual(s). The number of additional manuals depends on quantity of Option 910's ordered. To obtain additional Operating and Service manuals after initial shipment, order by manual part number (refer to title page or rear cover of manual).*

1-34. ACCESSORIES SUPPLIED

1-35. The 50 ohm coaxial termination, HP Part Number 11593A, is used to terminate the 8558B 1ST LO OUTPUT when that output is not being used. The 50 ohm coaxial termination is shown in Figure 1-1.

1-36. A Type-N Male to BNC Female adapter, HP Part Number 1250-0780, is supplied to provide convenience of using lightweight cables with BNC connectors. The adapter is shown in Figure 1-1.

1-37. A Side Stop Kit, HP Part Number 08558-60131, is supplied to secure the Spectrum Analyzer in the mainframe if desired. The side stops prevent the Spectrum Analyzer from sliding out of the mainframe unexpectedly. When the side stops are installed, the Spectrum Analyzer cannot be removed from the mainframe without first removing the side stops. Refer to paragraphs 2-11 and 2-12 in Section II for installation or removal of side stops.

1-38. Graticule overlays are supplied to provide the operator with greater ease of reading the information displayed. HP Part Number 5020-8565 is the overlay for 180-series oscilloscope mainframes, HP Part Number 5020-8566 is the overlay for 181-series oscilloscope mainframes, and HP Part Number 5020-8567 is the overlay for 182-series oscilloscope mainframes. For proper installation of graticule overlay, refer to Section II. The graticule overlays are shown in Figure 1-1.

1-39. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-40. Oscilloscope Display

1-41. The Hewlett-Packard Model 180T-series Oscilloscope is used for the display and mainframe for the HP Model 8558B. In order to be completely compatible to the 8558B, other Model 180-series Oscilloscopes should have Option 807 installed. This option provides the proper rear-panel auxiliary outputs for use with the 8558B Spectrum Analyzer. The Option 807 rear-panel auxiliary output connectors are labeled AUX A, AUX B, AUX C, and AUX D. They provide Vertical Output, Pen Lift Output, 21.4 MHz IF Output, and Horizontal Output, respectively.

1-42. If the Hewlett-Packard 180-series Oscilloscope (other than 180T-series) does not have Option 807 installed, only the horizontal, vertical, and blanking outputs will be available at the mainframe's rear panel. These outputs will be attenuated and shifted in dc level. (See Supplemental Performance Characteristics Table 1-2, GENERAL.) Modification Kit Number 00180-69503 may be used to provide the proper rear-panel auxiliary outputs for use with the 8558B Spectrum Analyzer. See Table 1-3.

1-43. EQUIPMENT AVAILABLE

1-44. Hewlett-Packard Model 1121A 500 MHz AC Probe

1-45. The HP Model 1121A active probe permits testing high-frequency circuits without significant loading effects. High input impedance is maintained by a field effect transistor (FET) circuit. The HP Model 8558B Spectrum Analyzer has a front panel PROBE PWR connector which permits the use of high impedance active probes such as the HP Model 1120A, HP Model 1121A, HP Model 1123A, or HP Model 1124A. The HP Model 1121A is preferred because of its low noise characteristics.

001 and 002: AC Probe has 50 Ω output impedance. Connection of probe to 75 Ω input of 8558B, Option 001 or 002, will cause +1.58 dB error in amplitude.

1-46. Hewlett-Packard 180-Series Oscilloscope Modification Kit (Option 807 Connections)

1-47. This Modification Kit (HP Part Number 00180-69503) provides the materials and information necessary to modify a standard HP 180-series oscilloscope. The modification provides installation of Option 807 rear-panel connections on the standard HP 180-Series oscilloscope. See Table 1-3 for description of parts and HP part numbers contained in Modification Kit.

1-48. Service Equipment Available

1-49. Table 1-4 describes equipment available from Hewlett-Packard that provides convenience in aligning and troubleshooting the 8558B Spectrum Analyzer.

1-50. RECOMMENDED TEST EQUIPMENT

1-51. Table 1-5 lists all of the equipment required for performance testing, adjustments, troubleshooting, and repair of the Hewlett-Packard Model 8558B Spectrum Analyzer. Other equipment may be substituted if it meets or exceeds the critical specifications listed in the table.

Table 1-3. Parts Included in Modification Kit 00180-69503

Quantity	Description	HP Part Number
1	Output Amplifier Assembly (Auxiliary Output Board)	00180-66548
1	Label	7120-3116
2	3/4 inch pieces of shrink tubing	0890-0720
1	Service Note	180A/AR-10, 180C/D-2, 181A/AR8, 182A/C-1, or 184/B-1 (only one Service Note is included, depending on model number)

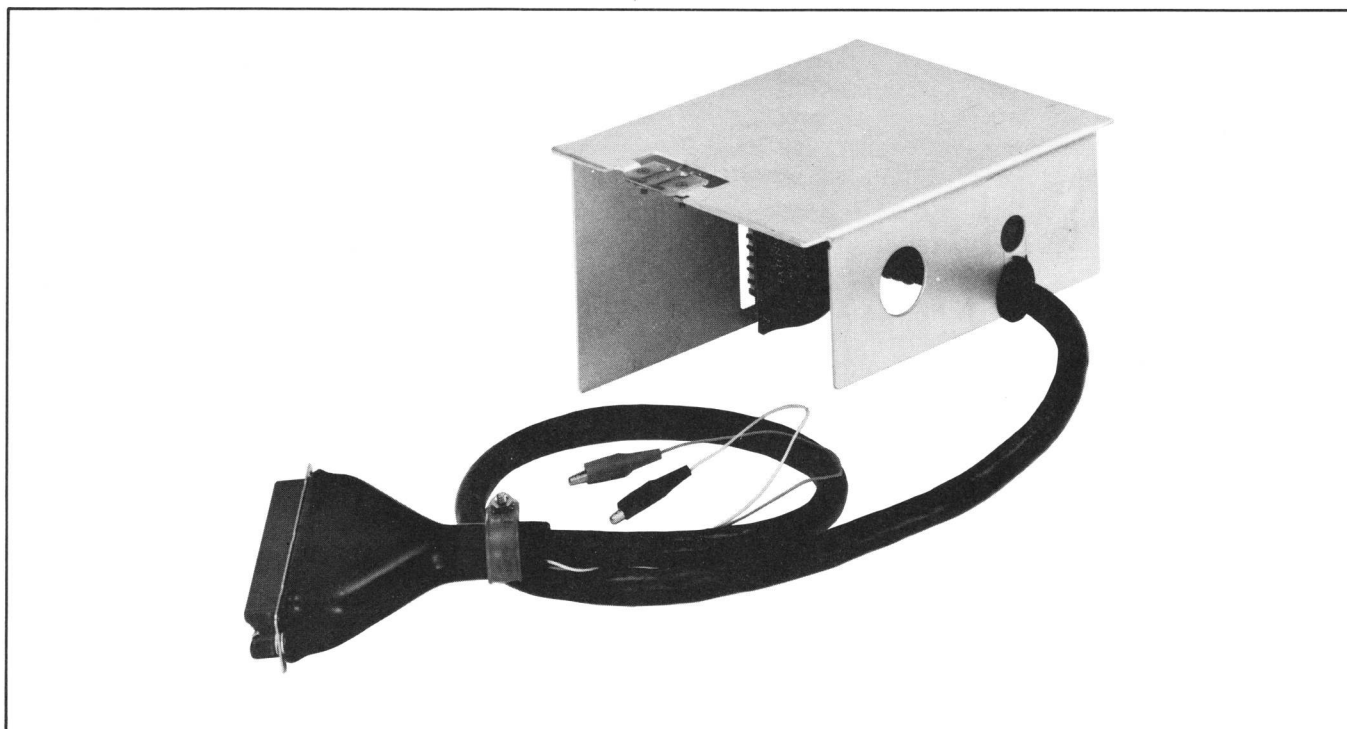


Figure 1-2. Extender Cable Assembly, HP Part Number 5060-0303

Table 1-4. Equipment Available for Servicing 8558B

Item	Required Features	Suggested Model
Board Puller	Two prongs to lift PC Boards	HP 03950-4001
*Extender Board	10 Pin, 20 Contacts	HP 5060-0256
*Extender Board	6 Pin, 12 Contacts	HP 5060-0257
*Extender Board	22 Pin, 44 Contacts	HP 5060-5990
Cable Assembly	Male BNC to Female Subminiature RF, 36 inches long	HP 11592-60001
Cable Assembly	Male Subminiature RF to Female Subminiature RF	HP 11592-60003
Cable Assembly	Male SMA to Male BNC	HP 08555-60076
Adapter	Subminiature RF, Female on both ends	HP 1250-1113
Adapter	Subminiature RF, Male on both ends	HP 1250-0827
Extender Cable Assembly (See Figure 1-2)	32 Contact Male and Female connectors specially adapter to extend all of the interconnections from the oscilloscope mainframe to the 8558B (or 8755A)	HP 5060-0303
Wrench	15/64 inch, Combination or open end	HP 8710-0946
Wrench	5/16 inch, Combination or open end	HP 8720-0015
*Rubber bumpers (HP Part Number 0403-0115) should be installed in the center of both sides of extender board. The rubber bumpers prevent the extender board from shorting against the 8558B chassis when in use.		

Table 1-5. Recommended Test Equipment (1 of 3)

Equipment	Critical Specifications	Recommended Model	Use*
Oscilloscope Mainframe	HP 180T Series or 180 Series with Option 807 and variable persistence	HP 181T	P, A, T
Oscilloscope	Time Base: 1 ms/cm to 10 ms/cm Vertical Sensitivity: 1 mV/cm to 20 V/cm	HP 182T/1801A/1820C	P, A, T
Frequency Counter	Frequency Range: 150 MHz to 1.5 GHz Sensitivity: -30 dBm	HP 5340A	P, A, T
Digital Voltmeter	Accuracy: $\pm(.05\% \text{ Rdg} \pm 1 \text{ digit})$	HP 34740A/34702A	P, A, T
Power Meter	Power Range: -20 dBm to +10 dBm	HP 435A	P, A, T
Power Sensor	Frequency Range: 10 MHz to 1.5 GHz Maximum SWR: 1.1, 0.1 to 1 GHz	HP 8482A	P, A, T
Amplifier	Frequency Range: 200 MHz to 300 MHz Gain: > 20 dB Impedance: 50 Ω	HP 8447A	P, A, T
Signal Generator (2 required)	Frequency Range: 5 MHz to 305 MHz Drift: Less than 50 ppm (or 5 Hz, whichever is greater) Noise Sidebands: > 80 dB down, 50 kHz away, 1 kHz BW	HP 8640B	P, A, T
Sweep Oscillator/ RF Unit	Frequency Range: 0.1 GHz to 1.5 GHz Maximum Leveled Power: > 6 mW	HP 8620C/86222A	P, A, T
Generator/Sweeper	Frequency Range: 100 kHz to 110 MHz Flatness: $\pm.25$ dB over full range, ± 0.1 dB over any 10 MHz portion (+10 dBm step or below)	HP 8601A	P, T
Comb Generator	Accuracy: 0.01%	HP 8406A	P, A, T
Audio Oscillator	Frequency Range: 5 kHz to 200 kHz Output Impedance: 600 Ω	HP 204C	P
Crystal Detector	Frequency Range: 10 MHz to 1.5 GHz Frequency Response: ± 0.2 dB/octave to 2 GHz; ± 0.5 dB overall	HP 423B	P, A, T
300 MHz LPF	Rejection: > 50 dB for signals above 300 MHz	Telonic TPL 300-4AB	P, A, T
* P = Performance Test; A = Adjustment; T = Troubleshooting			

Table 1-5. Recommended Test Equipment (2 of 3)

Equipment	Critical Specifications	Recommended Model	Use*
10 dB Attenuator (2 required)	Frequency Range: 100 kHz to 1.5 GHz Accuracy: ± 0.5 dB	HP 8491A Option 010	P, T
20 dB Attenuator	Frequency Range: 100 kHz to 1.5 GHz Accuracy: ± 0.5 dB	HP 8491A Option 020	P, T
Step Attenuator	Frequency Range: 20 MHz to 305 MHz Attenuation: 12 dB in 1-dB steps Accuracy: ± 0.25 dB	HP 355C	P, A, T
Step Attenuator	Frequency Range: 20 MHz to 305 MHz Attenuation: 80 dB in 10-dB steps calibrated at 30 MHz and 280 MHz by a Standards Lab Accuracy: ± 0.01 dB $\pm 0.02/10$ dB step at calibrated frequencies	HP 355D Option H82	P, A, T
Termination	Impedance: 50Ω	HP 11593A	P
Extender Cable Assembly	32 contact male and female connectors specially adapted to extend all of the interconnections from the oscilloscope mainframe to the 8558B	HP 5060-0303	A, T
BNC Cable, 6 inch	50Ω coaxial cable with male BNC connectors on both ends	HP 10502A	A, T
Adapter	Banana plugs on one end, BNC female on other end	HP 10111A	P, T
Adapter	BNC female on one end, alligator clips on other end	HP 8120-1292	A, T
Adapter	BNC female on one end, male on other end	HP 1250-1200	T
Adapter (3 required) Note: one provided with instrument	Type N male on one end, BNC female on other end	HP 1250-0780	P, A, T
Adapter	Type N female on both ends	HP 1250-0777	A, T
Adapter	Type N male on both ends	HP 1250-0778	P, T
Adapter	Type N male on one end, subminiature RF male on other end	HP 1250-1023	A, T
Adapter	Subminiature RF, female on both ends	HP 1250-1113	A, T
Adapter	Subminiature RF, male on both ends	HP 1250-0827	A, T

* P = Performance Test; A = Adjustment; T = Troubleshooting

Table 1-5. Recommended Test Equipment (3 of 3)

Equipment	Critical Specifications	Recommended Model	Use*
Type N Tee	Two female connectors and one male connector	UG-107 B/U	P, A, T
BNC Tee	Two female connectors and one male connector	HP 1250-0781	P, A, T
Extender Board	6 pin, 12 contacts with 51.1 Ω resistor from pin 1 to pin 5	HP 5060-0257 HP 0757-0394	A, T
Cable Assembly	Male BNC to Female Subminiature RF, 36 inches long	HP 11592-60001	A, T
NOTE The following equipment is required for Option 001 and 002.			
Termination	Impedance: 75 Ω	HP 11652-60010	P
Power Sensor	Frequency Range: 10 MHz to 2 GHz Maximum SWR: 1.18, 10 MHz to 2 GHz	HP 8483A	P, A, T
Adapter	75 Ω BNC Male to 75 Ω Type N Female	HP 1250-1534	P, T
Blocking Capacitor	75 Ω to 50 Ω , 5.72 dB attenuation	HP 08558-60031	P, T
Adapter	BNC male, both ends	HP 1250-0216	P, T
Adapter	BNC female on one end, SMA male on other end	HP 1250-1200	P, T
Adapter	SMA Female, both ends	HP 1250-1158	P, T
Adapter	N female, both ends	HP 1250-0777	P, T
Cable	75 Ω , 6-inch	HP 8120-0061	P, T
75 Ω Connectors (2 required)**	BNC male (used with 75 Ω cable)	HP 1250-1444 HP 1250-0266 HP 1250-0762 HP 1250-0763 HP 1250-0804 HP 1250-0805 HP 1250-0806 HP 1250-0807	P, T
* P = Performance Test; A = Adjustment; T = Troubleshooting ** Eight parts required for each 75Ω connector.			

SECTION II INSTALLATION

2-1. INTRODUCTION

2-2. This section covers initial inspection, installation of the instrument into a mainframe, and storage and shipping requirements.

2-3. INITIAL INSPECTION

2-4. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1, and procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for carrier's inspection. The HP office will arrange for repair or replacement without waiting for claim settlement.

2-5. PREPARATION FOR USE

2-6. Installation

2-7. When properly installed, the Plug-In obtains all necessary power from the mainframe. The rear panel connector provides the interface.

2-8. To install the Plug-In into the mainframe:

- a. Set Model 180-series mainframe LINE switch to OFF.
- b. Slide the plug-in into place toward rear of the compartment.
- c. Turn the LOCK knob located at the center of the front panel clockwise until the Plug-In is held solidly in the mainframe.

2-9. Side Stop Kit

2-10. The Side Stop Kit, HP Part Number 08558-60131 contains side stops, mounting hardware, label, and installation instructions, (refer to Table 2-1 for part numbers).

Table 2-1. Side Stop Kit (08558-60131)

Quantity	Description	HP Part Number	C D
2	SIDE STOP	08558-00094	7
4	MACHINE SCREW, 4-40 .438-IN-LG 82 DEG FLATHEAD	2200-0168	9
1	LABEL, FRONT-PANEL	7120-8131	7
1	LABEL, INSTRUCTIONS	7120-8215	8

2-11. To install side stops:

WARNING

Before removing covers from mainframe, disconnect line power.

a. Remove side covers from bottom section of mainframe. (Remove only right side cover if mainframe is a rackmount model.)

b. Install sidestops, HP Part Number 08558-00094, as shown in Figure 2-1 using 4-40 flathead machine screws, HP Part Number 2200-0168.

c. Reinstall side covers on mainframe.

d. Place label, HP Part Number 7210-8131 on front panel (upper right-hand corner) of Spectrum Analyzer to indicate that the plug-in is secured with side stops.

2-12. To remove side stops:

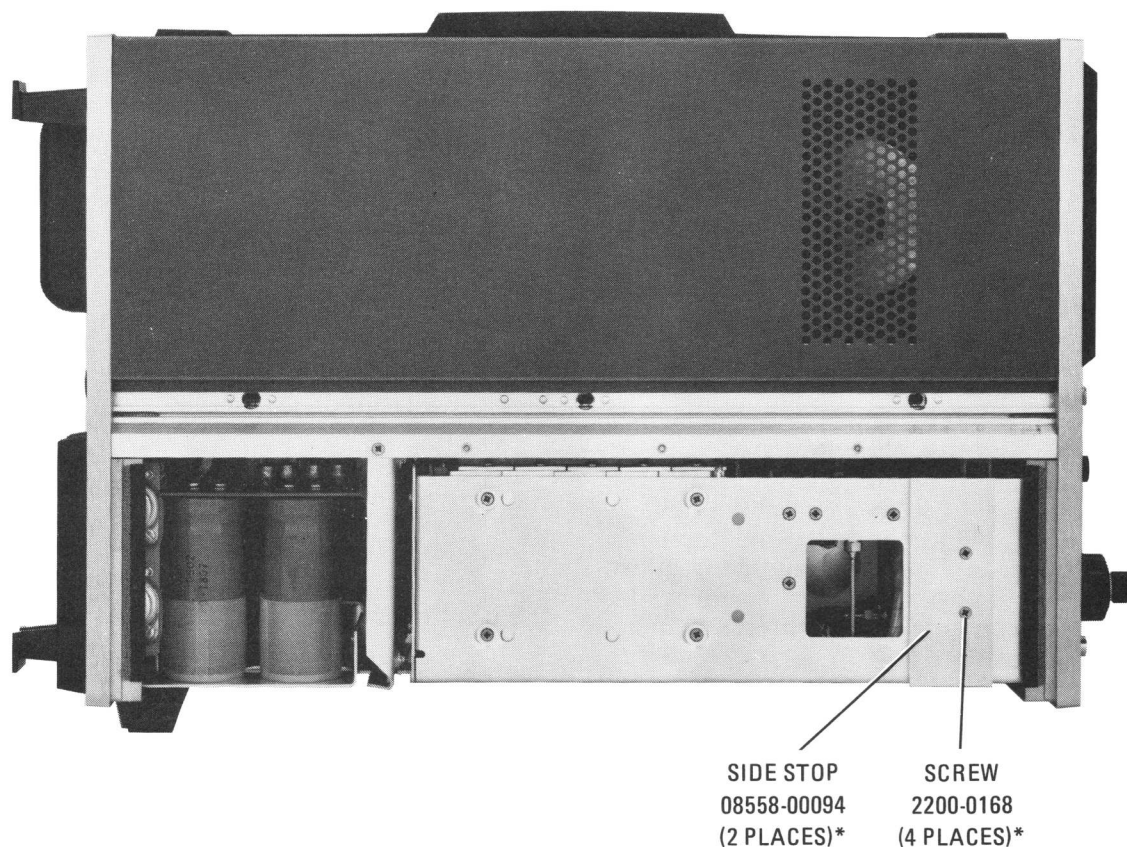
WARNING

Before removing covers from mainframe, disconnect line power.

a. Remove side covers from bottom section of mainframe. (Remove only right side cover if mainframe is a rackmount model.)

b. Remove side stops. See Figure 2-1.

c. Reinstall side covers on mainframe.



* Only one side stop and two screws are used for rackmount models

Figure 2-1. Location of Side Stops.

2-13. To install the graticule overlay:

a. Select the proper overlay. HP Part Number 5020-8565 is for 180-series oscilloscope mainframes, HP Part Number 5020-8566 is for 181-series oscilloscope mainframes, and HP Part Number 5020-8567 is for 182-series oscilloscope mainframes.

b. For 180-series and 181-series mainframes, remove CRT bezel and metallic mesh contrast filter, if used. Insert proper overlay and replace contrast filter and CRT bezel.

c. For 182-series mainframes, grasp top portion of CRT bezel and pull straight up. Remove contrast filter, if used, insert overlay, and replace top portion of CRT bezel. The metallic mesh contrast filter or the light blue contrast filter may be used with the overlay.

2-14. Interconnections

2-15. When the Hewlett-Packard Model 8558B is properly installed in the HP Model 180-Series Oscilloscope, the interconnections are as shown in Table 2-1.

2-16. Operating Environment

2-17. Temperature: The instrument may be operated in temperatures from 0°C to +55°C.

2-18. Humidity. The instrument may be operated in environments with humidity up to 95%. However, the instrument should also be protected from temperature extremes which cause condensation within the instrument.

2-19. Altitude. The instrument may be operated in altitudes up to 4572 meters (15,000 feet).

2-20. Modifications

2-21. Modification Kit Number 00180-69503 provides materials and information necessary to add Option 807 rear-panel connections on the standard HP 180-Series Oscilloscope. Refer to Table 1-3 in Section I. This modification is necessary only if all four rear-panel outputs are needed, but is not necessarily required to use the 8558B in a 180-series mainframe.

2-22. STORAGE AND SHIPMENT

2-23. Environment

2-24. The instrument may be stored or shipped in environments within the following limits:

Temperature: -40°C to $+75^{\circ}\text{C}$

Humidity: Up to 95%

Altitude: Up to 7620 meters (25,000 feet)

The instrument should also be protected from temperature extremes which cause condensation within the instrument.

2-25. Packaging

2-26. **Original Packaging.** Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the

instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-27. **Other Packaging.** The following general instructions should be used for re-packaging with commercially available materials:

a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard office or service center, attach a tag indicating the type of service required, return address, model number, and full serial number.)

b. Use a strong shipping container. A double-wall carton made of 350-pound test material is adequate.

c. Use enough shock-absorbing material (3-inch to 4-inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely.

e. Mark the shipping container FRAGILE to assure careful handling.

Table 2-2. 8558B Mainframe Interconnections

Pin on P1	Signal or Voltage
1	CRT HORIZ Adjustment Signal
2	GROUND from Mainframe (jumpered to Pin 8 of P1)
3	N.C.
4	L NORM
5	Y NORM
6	N.C.
7	N.C.
8	GROUND from mainframe (jumpered to Pin 2 of P1)
9	N.C.
10	N.C.
11	AUX D Horizontal Output to mainframe rear panel
12	AUX C 21.4 MHz IF Output to mainframe rear panel
13	AUX B Pen Lift/Blanking Output to mainframe rear panel
14	AUX A Vertical Output to mainframe rear panel
15	GROUND
16	N.C.
17	BLANKING
18	N.C.
19	GROUND from mainframe (jumpered to Pin 24 of P1)
20	N.C.
21	BEAM FINDER circuit
22	N.C.
23	N.C.
24	GROUND from mainframe (jumpered to Pin 19 of P1)
25	N.C.
26	N.C.
27	N.C.
28	-12.6 Vdc from mainframe
29	+15 Vdc from mainframe
30	+100 Vdc from mainframe
31	20 VAC from mainframe (Line sync.)
32	N.C.
W10P3 (2 contacts)	Vertical deflection to CRT

SECTION III OPERATION

3-1. INTRODUCTION

3-2. This section provides complete operating instructions for 8558B Spectrum Analyzer. It also provides a brief description of oscilloscope-mainframe controls. For a detailed description of the oscilloscope mainframe, refer to its manual.

3-3. CONTROLS, INDICATORS, AND CONNECTORS

3-4. The Spectrum Analyzer is used with one of the 180-series oscilloscope mainframes. The 180T-series oscilloscope mainframes, or the 180-series mainframes with Option 807, have the correct rear-panel connections for Spectrum Analyzer horizontal, vertical, penlift, and IF outputs. Figure 3-1 shows the front-panel features of the 8558B Spectrum Analyzer. Figure 3-4 shows the rear-panel features of the oscilloscope mainframe along with the rear-panel features of the 8558B. The rear panels of all 180T-series mainframes, and 180-series mainframes with Option 807, are basically the same. Figures 3-2 and 3-3 show front-panel features of the 8558B with Option 001 and Option 002 respectively.

3-5. OPERATOR'S CHECKS

3-6. Upon receipt of the Analyzer, or if the mainframe is changed, perform the operational adjustments listed in Figure 3-5. This procedure corrects for minor differences between units and ensures that the analyzer and mainframe are properly matched.

3-7. OPERATING CONSIDERATIONS

3-8. Control Grouping

3-9. The Spectrum Analyzer and Oscilloscope Mainframe front-panel controls fall into three general groups: those that deal with the display, those that deal with frequency, and those that deal with amplitude.

3-10. **Display.** The display group consists of:

SWEEP TIME/DIV	VIDEO FILTER
SWEEP TRIGGER	BASELINE CLIPPER
VERT POSN	HORIZONTAL POSITION
VERT GAIN	INTENSITY
MANUAL SWEEP	FOCUS
HORIZ GAIN (rear panel of 8558B)	TRACE ALIGN
	ASTIG

In addition, the variable persistence and storage controls on the HP 181T/TR fall into this category.

3-11. The display group enables the operator to calibrate the display and to select a variety of scan and display conditions. The controls are explained in Figure 3-1. However, when the SWEEP TIME/DIV Control is placed in the AUTO position, sweep time is controlled by the RESOLUTION BW, FREQ SPAN/DIV, and VIDEO FILTER controls.

3-12. **Frequency.** The frequency group consists of:

TUNING
RESOLUTION BW
FREQ SPAN/DIV

3-13. The frequency group enables the operator to control how the Spectrum Analyzer displays the frequency domain. The RESOLUTION BW and FREQ SPAN/DIV controls when pushed in are coupled together, and moving either control moves the other. When the SWEEP TIME/DIV control is in the AUTO position, varying the RESOLUTION BW or the FREQ SPAN/DIV (coupled or uncoupled) will change the sweep time to maintain calibration. With the two controls coupled together in the optimum position, RESOLUTION BW's of 1 MHz to 1 kHz will be automatically selected as the FREQ SPAN/DIV is narrowed from 100 MHz/DIV to 5 kHz/DIV. The FREQ SPAN/DIV control permits the operator to look at a spectrum that varies in width from zero to 1000 MHz. TUNING controls coarse and fine (coarse is larger knob) set the center frequency or starting frequency of the displayed spectrum. RESOLUTION BW control determines the resolution of the signals on the CRT.

3-14. Amplitude.

The amplitude group consists of:

REFERENCE LEVEL dBm — OPTIMUM INPUT
 002: REFERENCE LEVEL (dBmV) —
 OPTIMUM INPUT
 REF LEVEL FINE
 REF LEVEL CAL
 10 dB/DIV — 1 dB/DIV — LIN

3-15. The amplitude group enables the operator to measure signal amplitude in units of either voltage or dBm. The REFERENCE LEVEL dBm — OPTIMUM INPUT knob controls two functions with one control knob.

002: REFERENCE LEVEL (dBmV) —
 OPTIMUM INPUT

Pushing in and turning the large knob sets the amount of attenuation in the input attenuator. The pointer set to an optimum input of -40 dBm corresponds to zero dB of attenuation in the input attenuator. Pushing in and turning from the -40 dBm to the $+30$ dBm positions adds input attenuation in 10 dB steps. When the power level of the input signal being measured is equal to or less than the OPTIMUM INPUT setting, the signal level at the input mixer is equal to or less than -40 dBm. A signal level of -40 dBm or less at the input mixer assures the operator of at least 70 dB of spurious-free measurement range on the Spectrum Analyzer display. Turning the REFERENCE LEVEL dBm — OPTIMUM INPUT knob without pushing in calibrates the top graticule line to the power level indicated in the REF LEVEL dBm window, provided the REF LEVEL CAL control has been properly adjusted. The REF LEVEL FINE control allows the operator to calibrate the top graticule line in $\frac{1}{2}$ dB increments.

001: Change " -40 dBm" to " -35 dBm" in four places.

002: Change " -40 dBm" to " $+15$ dBmV" in four places. Change " $+30$ dBm" to " $+80$ dBmV."

3-16.

CAUTION

Excessive input power will damage the 8558B input attenuator and input mixer. The analyzer input signal must not exceed the values listed in Table 3-1 for the specified input attenuation settings listed.

If the operator is only interested in measuring amplitude, the signal at the mixer can be as high as -10 dBm. (Signals above this level will compress.)

002: $+45$ dBmV.

3-17. Variable Persistence and Storage Functions

3-18. With the 181T/TR Oscilloscope Mainframe, the operator can set trace persistence for a bright, steady trace that does not flicker, even on the slow sweeps required for narrow band analysis. The variable persistence also permits the display of low repetition rate pulses without flickering and, using the longest persistence, intermittent signals can be captured and displayed. The storage capability allows side-by-side comparison of changing signals.

Table 3-1. Input Power Limitations

Input Attenuation Set to:	Input Signal Must Not Exceed	Option 002 Only
0 dB	$+10$ dBm	$+60$ dBmV
10 dB	$+20$ dBm	$+70$ dBmV
20 dB	$+30$ dBm	$+80$ dBmV
30 dB	$+30$ dBm	$+80$ dBmV
40 dB	$+30$ dBm	$+80$ dBmV
50 dB	$+30$ dBm	$+80$ dBmV
60 dB	$+30$ dBm	$+80$ dBmV
70 dB	$+30$ dBm	$+80$ dBmV

3-19. Persistence and Intensity.

CAUTION

Excessive INTENSITY may damage the CRT storage mesh. The INTENSITY setting for any sweep speed should just eliminate trace blooming with minimum PERSISTENCE setting.

These controls largely determine how a written signal will be visible. Specifically, PERSISTENCE controls the rate at which a signal is erased and INTENSITY controls the trace brightness as the signal is written. With a given PERSISTENCE setting, the actual time of trace visibility can be increased by greater INTENSITY. Since the PERSISTENCE control sets the rate of erasing a written signal, it follows that a brighter trace will require more time to be erased. Conversely, a display of low intensity will disappear more rapidly. The same principle applies to a stored display of high and low intensity.

3-20. Storage. These controls select the storage mode in which the CRT functions. In ERASE mode, STORE, WRITE, and MAX WRITE are disconnected and all written signals are removed from the CRT. The STORE selector disconnects the

WRITE, MAX WRITE, and ERASE functions and implements signal retention at reduced intensity. In the STORE mode, PERSISTENCE and INTENSITY have no function.

3-21. Writing Speed. In the MAX WRITE mode, the CRT storage surface is primed to allow much faster writing on the storage surface. Since the erasing rate is decreased, the entire screen becomes illuminated more rapidly and the display is obscured. The effective persistence and storage times are thus considerably reduced. (MAX WRITE will not normally be used with a spectrum analyzer plug-in.)

3-22. Photographic Techniques

3-23. Excellent oscillographic photography is possible when the Spectrum Analyzer is used with proper optics and when proper techniques are employed. The HP Model 197A Oscilloscope Camera attaches directly to the analyzer's CRT bezel without adapters. Internal flood guns in the CRT provide background lighting of the display. When photography of stored traces (181T/TR) is required, a double exposure will be needed. (Flood guns are turned off when STORE is pressed.) See Application Note AN 150-5 for full details.

3-24. APPLICATIONS OF SPECTRUM ANALYSIS

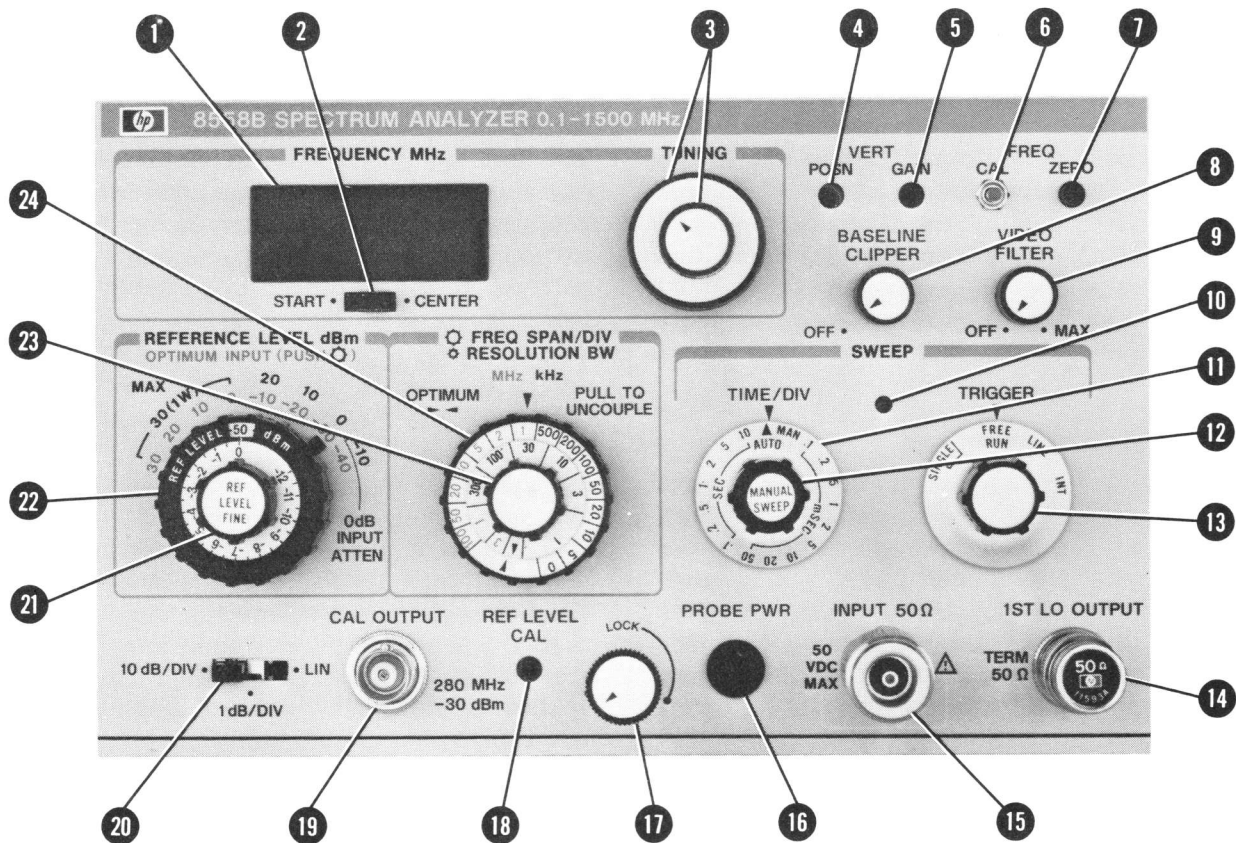
3-25. Signal analysis in the frequency domain is recognized as a tremendous aid in the evaluation of

circuits and systems. Frequency-domain techniques are logical, easy to use, and the results are easy to interpret. Some of the more important frequency-domain phenomena are: distortion of oscillators; frequency response, parasitic oscillations, and distortion characteristics of amplifiers; frequency parameters of networks and filters; and all types of modulation.

3-26. The Spectrum Analyzer is capable of analytically resolving almost any problem whose unknowns are amplitude and frequency; thus, over and above the general-purpose applications, the instrument is a powerful observation-and-measurement tool for surveillance, EMC, and systems work. To define each instrument application is beyond the scope of this manual. For further details, there are complete discussions of spectrum analyzer application in the 150-series of Application Notes. AN 150B serves as an operating supplement to this manual. Application notes are available from the nearest HP Sales and Service Office.

FRONT PANEL FEATURES

(See page 3-6 for Options 001 and 002.)



- 1 FREQUENCY MHz Indicator.** Provides LED readout of the frequency at center or start of CRT, depending on position of START — CENTER switch **2**.
- 2 START — CENTER Switch.** This switch selects the frequency indicated on the FREQUENCY MHz indicator **1** to be the frequency at the center of CRT with the switch in CENTER position, or the frequency at the left hand edge of CRT with the switch in START position.
- 3 TUNING Control.** This control consists of two parts, a coarse-tuning control (larger diameter knob) and a fine-tuning control (smaller diameter knob). The TUNING control tunes the center frequency or start frequency of the spectrum displayed, depending on the position of the START — CENTER switch **2**.
- 4 VERT POSN Control.** This control adjusts the 8558B vertical driver to properly position the trace on the Oscilloscope.
- 5 VERT GAIN Control.** This control adjusts the 8558B vertical driver for proper vertical calibration of the Spectrum Analyzer. Compensates for a difference in vertical gain of different oscilloscope mainframes.
- 6 FREQ CAL Switch.** Removes YIG oscillator magnetic hysteresis, providing greater accuracy of frequency reading. After tuning frequency more than 50 MHz, press to close switch momentarily and then release it.
- 7 FREQ ZERO Control.** This control adjusts the FREQUENCY MHz indicator **1** to zero when the TUNING control **3** has LO feed-through centered. (START — CENTER switch

Figure 3-1. Front Panel Controls, Connectors, and Indicators (1 of 2)

FRONT PANEL FEATURES

2 must be in center position.) Always press **FREQ CAL** switch **6** two or three times in succession before making final **FREQ ZERO** adjustment. The **FREQ ZERO** control may also be used to calibrate the center frequency anywhere in the frequency spectrum from 0 to 1500 MHz.

8 **BASELINE CLIPPER Control.** This control blanks the lower part of the CRT baseline noise. Blanking function is useful to prevent blooming with a variable-persistence storage oscilloscope mainframe and for viewing low repetition rate pulses.

9 **VIDEO FILTER Control.** This control is a variable post-detection video filter which smooths the display by averaging background noise. The **MAX** detent position (fully clockwise) selects a 1.5 Hz video filter and decreased **AUTO** sweep time for maximum noise averaging. The **VIDEO FILTER** control is one of the controls that determines sweep time when the **SWEEP TIME/DIV** control **11** is in the **AUTO** sweep mode.

10 **SWEEP Indicator.** Lights for the duration of each sweep.

11 **SWEEP TIME/DIV Control.** Controls sweep time in 0.1 mSEC to 10 SEC per division settings. **MAN** position permits manual sweep. In **AUTO** position the correct sweep time is controlled by **FREQ SPAN/DIV** control **24**, **RESOLUTION BW** control **23**, and **VIDEO FILTER** Control **9** to maintain absolute amplitude calibration.

12 **MANUAL SWEEP Control.** Controls sweep in **MAN** position of **SWEEP TIME/DIV** control **11**.

13 **SWEEP TRIGGER Control.** Selects sweep trigger mode and single sweep. When in **SINGLE** sweep position, this control must be turned clockwise to initiate or to stop a sweep. In **INT** sweep position, the 8558B is video triggered. No sweep will occur unless noise level is greater than half a division.

14 **1ST LO OUTPUT Connector.** This 50 ohm BNC connector provides a 2.05 GHz to 3.55 GHz output signal from the YIG oscillator. This connector should be terminated into the provided 50-ohm load (HP 11593A) when not in use.

15 **INPUT 50Ω CONNECTOR.** 50 ohm input for 0.1 to 1500 MHz signals to be measured.
001 and 002: Input 75Ω connector.

16 **PROBE PWR Connector.** Supplies power for high impedance probes such as the HP Models 1120A, 1121A, 1123A, and 1124A. The HP Model 1121A Active Probe is preferred because of its low noise characteristics.
001 and 002: Use of probe with 75Ω connector will cause +1.58 dB error in amplitude.

17 **LOCK Knob.** This knob pulls out for easier turning and to provide a handle for removing the analyzer from the oscilloscope mainframe. When the knob is turned to the **LOCK** position (fully clockwise) the 8558B is locked into the oscilloscope mainframe. When the knob is turned (fully counterclockwise), the 8558B is free to move in or out of the oscilloscope mainframe provided the side stops have not been installed (refer to Paragraph 2-12).

18 **REF LEVEL CAL Control.** Calibrates display amplitude for absolute power measurements.

19 **CAL OUTPUT Connector.** This BNC connector provides a 280 MHz signal at -30 dBm for

calibration of the Spectrum Analyzer. A short cable with male BNC connectors and a BNC to Type N adapter should be used to feed the **CAL OUTPUT** signal into the **INPUT 50Ω** connector **15**.

002: 280 MHz signal at +20 dBmV.
001 and 002: Use 75Ω male BNC connectors.

20 **10 dB/DIV - 1 dB/DIV - LIN Switch.** Selects log (1 dB/DIV or 10 dB/DIV) or linear display modes.

21 **REF LEVEL FINE Control.** Provides continuous control of the analyzer's amplitude reference level. This control has a range of 0 dB to 12 dB and is calibrated in ½ dB increments. The **REF LEVEL FINE** control setting should be added to the setting displayed in the open window of the **REFERENCE LEVEL dBm - OPTIMUM INPUT** control **22**. For example, if -30 is displayed in the open window and the **REF LEVEL FINE** control is set at -2, the actual reference level (top graticule line) is -32 dBm.

22 **REFERENCE LEVEL dBm - OPTIMUM INPUT Control.** Controls display amplitude calibration. The number displayed in the open window indicates the dBm level of the CRT top graticule line with **REF LEVEL FINE** control set at 0. Turn control to select desired amplitude calibration. The optimum and maximum input level selected is designated by the pointer behind the control. Push in control and turn to select input level range needed. Controls the Input Attenuator from 0 to 70 dB.

The **MAX** input level (outer circle) indicates maximum allowable input signal level for less than 1 dB gain compression. The **OPTIMUM INPUT** level (inner circle) indicates maximum input level for greater than 70 dB spurious-free dynamic range.

002: **REFERENCE LEVEL (dBmV) - OPTIMUM INPUT.**

23 **RESOLUTION BW Control.** This control selects resolution bandwidth from 1 kHz to 3 MHz. The blue numbers are in MHz and the black numbers are in kHz. The **RESOLUTION BW** control is coupled with the **FREQ SPAN/DIV** control **24** unless pulled out. The **RESOLUTION BW** control is one of the controls which determines sweep time when the **SWEEP TIME/DIV** control **11** is in the **AUTO** sweep mode.

24 **FREQ SPAN/DIV Control.** This control selects the CRT horizontal frequency calibration. The blue numbers are MHz/Div and black numbers are kHz/Div calibrations. When in 0 position, the frequency is not swept (fixed tuned) and the display shows amplitude variations of the input signal versus time. The **FREQ SPAN/DIV** control is one of the controls which determines sweep time when the **SWEEP TIME/DIV** control **11** is in the **AUTO** sweep mode. Unless the **FREQ SPAN/DIV** control is pulled out, it is coupled with the **RESOLUTION BW** control **23**. When the controls are coupled and aligned in the optimum position, the optimum **RESOLUTION BW** is selected for any **FREQ SPAN/DIV** setting.

OPTION 001 FRONT PANEL FEATURES

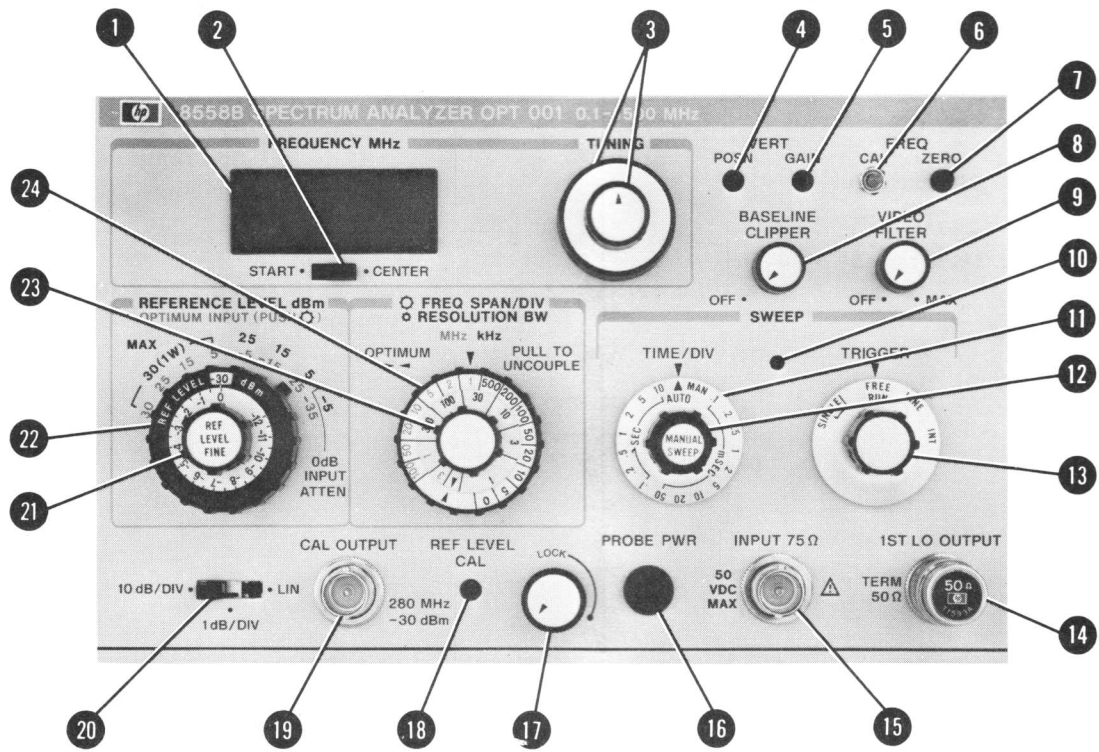


Figure 3-2. Front Panel Controls, Connectors, and Indicators (Option 001)

OPTION 002 FRONT PANEL FEATURES

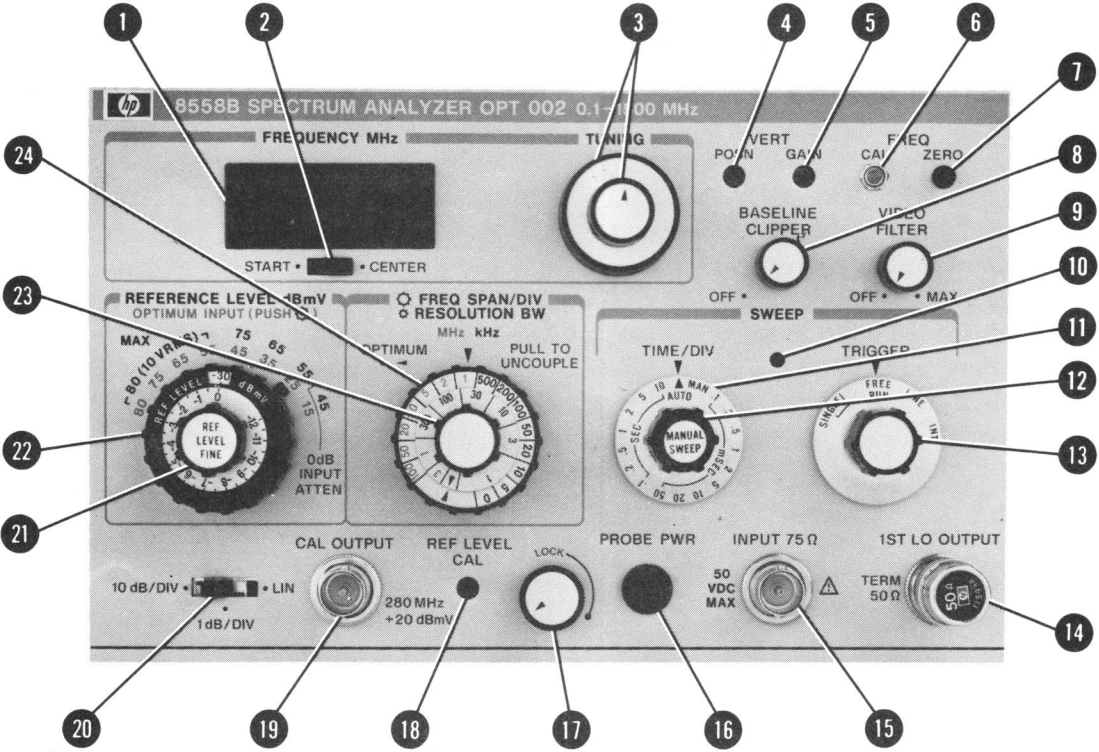
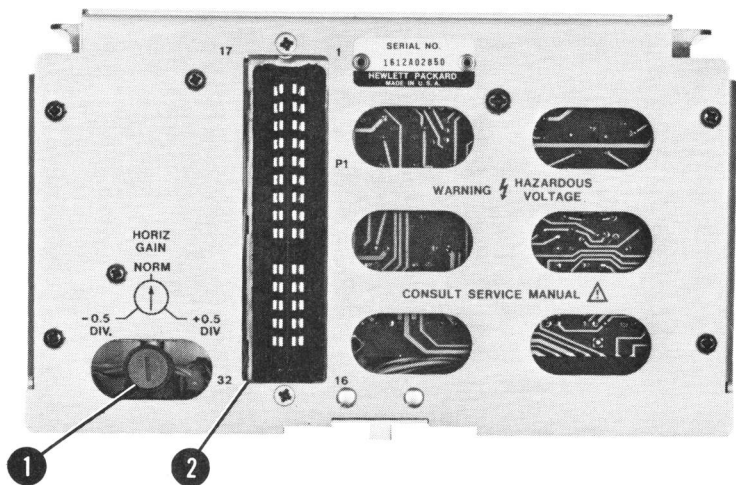


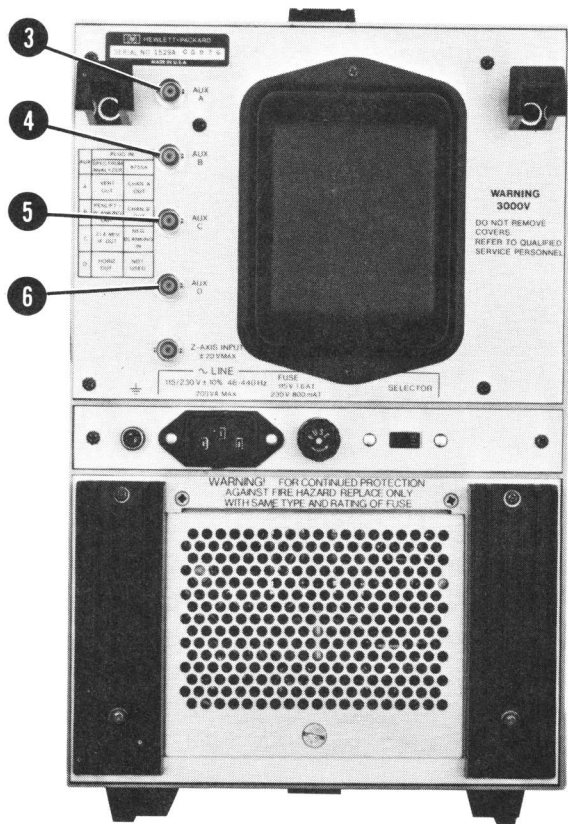
Figure 3-3. Front Panel Controls, Connectors, and Indicators (Option 002)

Figure 3-1. Front Panel Controls, Connectors, and Indicators (2 of 2)

REAR PANEL FEATURES



8558B Spectrum Analyzer Rear Panel



Oscilloscope Mainframe (182T) Rear Panel

Figure 3-4. Rear Panel Controls and Connectors (1 of 2)

REAR PANEL FEATURES

1 **HORIZ GAIN Control.** This control is used to adjust the horizontal gain for a full 10 divisions of horizontal deflection. Spectrum Analyzer must be removed to adjust this control. Adjustment is made to compensate for any difference in horizontal gain characteristics of different oscilloscope mainframes.

2 **P1 Connector.** Interconnects to oscilloscope mainframe.

3 **AUX A Vertical Output.** Provides detected video output of 0 volts to 0.8 volts for 8 divisions of CRT display deflection. The output impedance is 50 ohms. On oscilloscope mainframes without the AUX A output, the rear-panel MAIN GATE OUTPUT connector may be used to provide detected video output. The MAIN GATE OUTPUT is approximately +0.7V to +1.0V with a load greater than 600 ohms. Output impedance is less than 100 ohms.

4 **AUX B Pen Lift Blanking Output.** Provides a positive pulse from 0 volts to +15 volts. The zero volt level provides a pen-down signal and the +15 volt level provides a blanking signal with an impedance of approximately 10K ohms. This output signal is compatible with HP Models 7004B, 7034B, 7005B, and 7035B X-Y Recorders. On oscilloscope mainframes without the AUX B output, the rear-panel DELAYED GATE OUTPUT may be used for

blanking. The DELAYED GATE OUTPUT is approximately +0.7V to +3.1V (+0.7V unblanked) with a load greater than 1500 ohms. Output impedance is less than 100 ohms.

CAUTION

Do *NOT* connect X-Y recorder to 180-series DELAYED GATE OUTPUT or damage to the oscilloscope mainframe will result.

5 **AUX C 21.4 MHz IF Output.** Provides 21.4 MHz IF output linearly related to the RF input to the Spectrum Analyzer. The bandwidth and amplitude are controlled by the Spectrum Analyzer front panel controls. The output impedance is 50 ohms. This output is available only on 180T-series oscilloscope mainframes, and 180-series mainframes with Option 807 installed.

6 **AUX D Horizontal Output.** Provides a horizontal sweep voltage from -5 volts to +5 volts for 10 divisions of CRT display deflection. The output impedance is 5K ohms. On oscilloscope mainframes without the AUX D output, the rear-panel MAIN SWEEP OUTPUT may be used to provide a horizontal sweep voltage from approximately -1.5V to +0.2V with a load greater than 600 ohms. Output impedance is less than 100 ohms.

Figure 3-4. Rear Panel Controls and Connectors (2 of 2)

OPERATOR'S CHECK

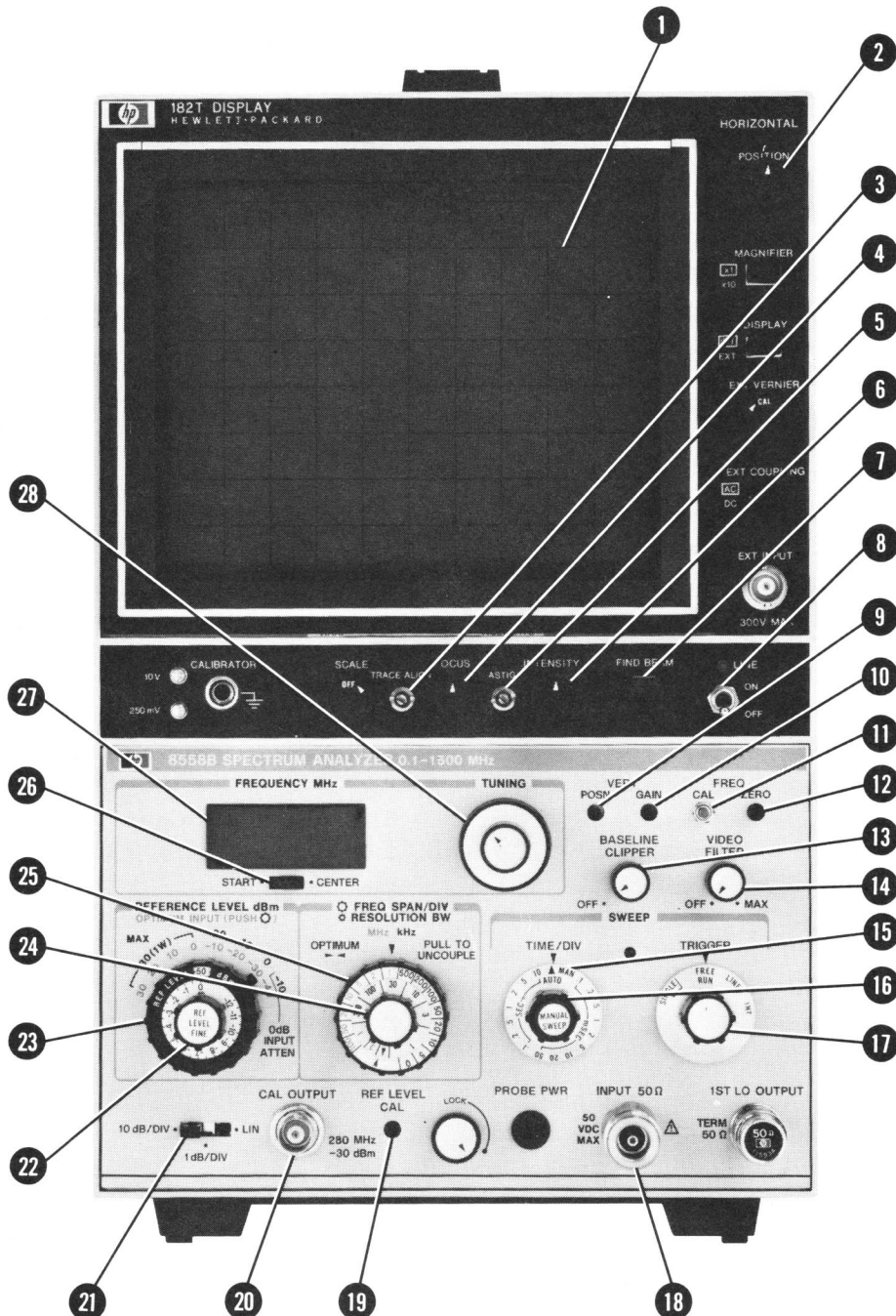
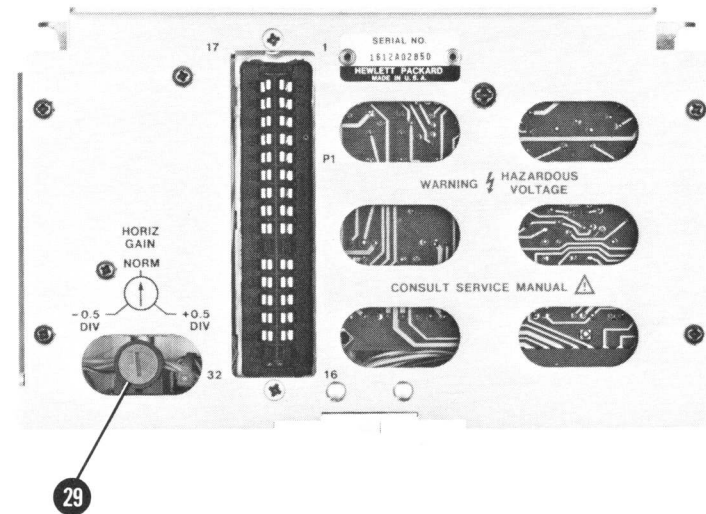


Figure 3-5. Operator's Check (1 of 2)

OPERATOR'S CHECK

1. Set oscilloscope mainframe 115/230 switch or check to see that POWER MODULE circuit card is installed correctly to correspond with available input voltage. The instrument is fused for 115-volts, 50/60 Hz operation; if 230-volt power is used, refer to the oscilloscope mainframe Service Manual for fuse replacement procedures.
2. Set mainframe LINE switch **8** to ON position. LINE indicator should be lit.
3. Turn BASELINE CLIPPER control **13** and VIDEO FILTER control **14** fully counterclockwise.
4. Set START-CENTER Switch **26** to START and FREQ SPAN/DIV control **25** to 10 MHz.
5. Push in REFERENCE LEVEL dBm — OPTIMUM INPUT control **23** and set optimum input pointer to -30 dBm (10 dB of input attenuation). Release and turn fully counterclockwise (REF LEVEL dBm setting of 0).
001: Set OPTIMUM INPUT pointer to -25 dBm.
002: Set OPTIMUM INPUT pointer to $+25$ dBmV. (REF LEVEL 50 dBmV.)
6. Pull out on FREQ SPAN/DIV control **25** to uncouple RESOLUTION BW control **24** from the FREQ SPAN/DIV control.
7. Set RESOLUTION BW control **24** to either 300 kHz position and set 10 dB/DIV — 1 dB/DIV — LIN switch **21** to LIN.
8. Set the SWEEP TIME/DIV control **15** to MAN (manual position).
9. Turn the MANUAL SWEEP control **16** to center dot on horizontal axis of CRT DISPLAY **1**.
10. Turn the VERT POSN control **9** until dot is 3 divisions above bottom graticule line.
11. Adjust the FOCUS **4** and ASTIG **5** controls until combined effect produces smallest round dot possible.
12. Set SWEEP TIME/DIV control **15** to AUTO position and set SWEEP TRIGGER control **17** to FREE RUN position. Adjust INTENSITY control **6** for optimum trace.
13. Adjust TRACE ALIGN control **3** until trace is aligned with horizontal line of graticule.
14. Set the HORIZONTAL POSITION control **2** to center the trace on the display.
15. Check that the trace begins at the first graticule line and ends at the last graticule line. If the trace is too long or too short, remove the Spectrum Analyzer from the oscilloscope mainframe and adjust the HORIZ GAIN control **29** to increase or decrease gain as marked on rear panel



16. Readjust the HORIZONTAL POSITION Control **2** so trace begins at first line of graticule and ends at last graticule line.
17. Readjust the VERT POSN control **9** until trace aligns with bottom line of graticule at the center of the display. Set 10 dB/DIV — 1 dB/DIV — LIN switch **21** to 10 dB/DIV and turn VIDEO FILTER control **14** to 2 o'clock position.
18. Connect the CAL OUTPUT **20** (280 MHz -30 dBm) signal to RF input (INPUT 50 Ω connector **18**).
002: $+20$ dBmV.
001 and 002: 75 Ω .
19. Set the FREQ SPAN/DIV control **25** to 100 MHz and RESOLUTION BW control **24** to 1 MHz.
20. Place the START—CENTER switch **26** in the CENTER position.
21. Turn the REFERENCE LEVEL dBm control **23** (without pushing in) until 0 appears in the REF LEVEL window.
002: 50 in window.
22. Turn the TUNING control **28** to center the LO feedthrough signal on the center vertical graticule line (larger knob is coarse control, smaller knob in fine control). The 280 MHz calibrator signal from CAL OUTPUT will be 2.8 divisions to the right of the LO feedthrough.
23. Set the FREQ SPAN/DIV control **25** to 1 MHz and center the LO feedthrough.
24. Press the FREQ CAL switch **11** two or three times to remove YIG oscillator magnetic hysteresis. Re-center the LO feedthrough signal with TUNING control **28**, if necessary.
25. Turn the FREQ ZERO control **12** until FREQUENCY MHz indicator **27** reads all zeros. LED frequency readout and display are now calibrated with the LO feedthrough at center graticule line.

26. Move the START — CENTER switch **26** to the START position. The LO feedthrough will move to the vertical graticule reference line (left side of display) which is now zero frequency. Return the switch to CENTER position.
27. Turn the TUNING control **28** to center the 280 MHz calibrator signal. Press FREQ CAL switch **11** two or three times and retune with TUNING control to center the signal as necessary. FREQUENCY MHz indicator will read 280 MHz $\pm$ 5 MHz.
28. Turn the REFERENCE LEVEL dBm control **23** (without pushing in) until -20 appears in the REF LEVEL dBm window.
002: 30 in window.
29. Set the 10 dB/DIV — 1 dB/DIV — LIN switch **21** to LIN.
30. Rotate the REF LEVEL FINE control **22** clockwise until signal is at the top graticule line.
31. Set the 10 dB/DIV — 1 dB/DIV — LIN switch **21** to 10 dB/DIV. Adjust VERT GAIN **10** until signal is at the top graticule line.
32. Repeat steps 29 through 31 until signal is at the top graticule line in both LIN and 10 dB/DIV.
33. Turn the REFERENCE LEVEL dBm control **23** (without pushing in) until -30 appears in the REF LEVEL window. Set REF LEVEL FINE control **22** to zero.
002: 20 in window
34. Set 10 dB/DIV — 1 dB/DIV — LIN switch **21** to LIN and adjust REF LEVEL CAL control **19** to place signal at the top graticule line.
35. Spectrum Analyzer is now calibrated for absolute amplitude and frequency measurements.
36. Set the 10 dB/DIV — 1 dB/DIV — LIN switch **21** to 10 dB/DIV.
37. Set the RESOLUTION BW control **24** to the 30 kHz position to align optimum markings and push in to couple with the FREQ SPAN/DIV control **25**.
38. Turn FREQ SPAN/DIV **25** and RESOLUTION BW **24** controls together and observe change in sweep time. Signal peak should remain at top graticule line. Return control to the 100 MHz FREQ SPAN/DIV position.
39. Turn the VIDEO FILTER control **14** clockwise and observe the change in sweep time and video filtering. Turn the control fully clockwise (MAX detent) and observe maximum noise averaging. Signals will reduce to the baseline. Return the control to the fully counterclockwise position.
40. Turn SWEEP TIME/DIV control **15** through sweep times and observe changes in sweep time. Turn control to the AUTO position.

NOTES

The display will not be calibrated for sweep times of less than 2 mSEC/DIV.

Do not use FIND BEAM Control **7** when using the 8558B in the oscilloscope mainframe.

Figure 3-5. Operator's Check (2 of 2)

GENERAL OPERATING PROCEDURE

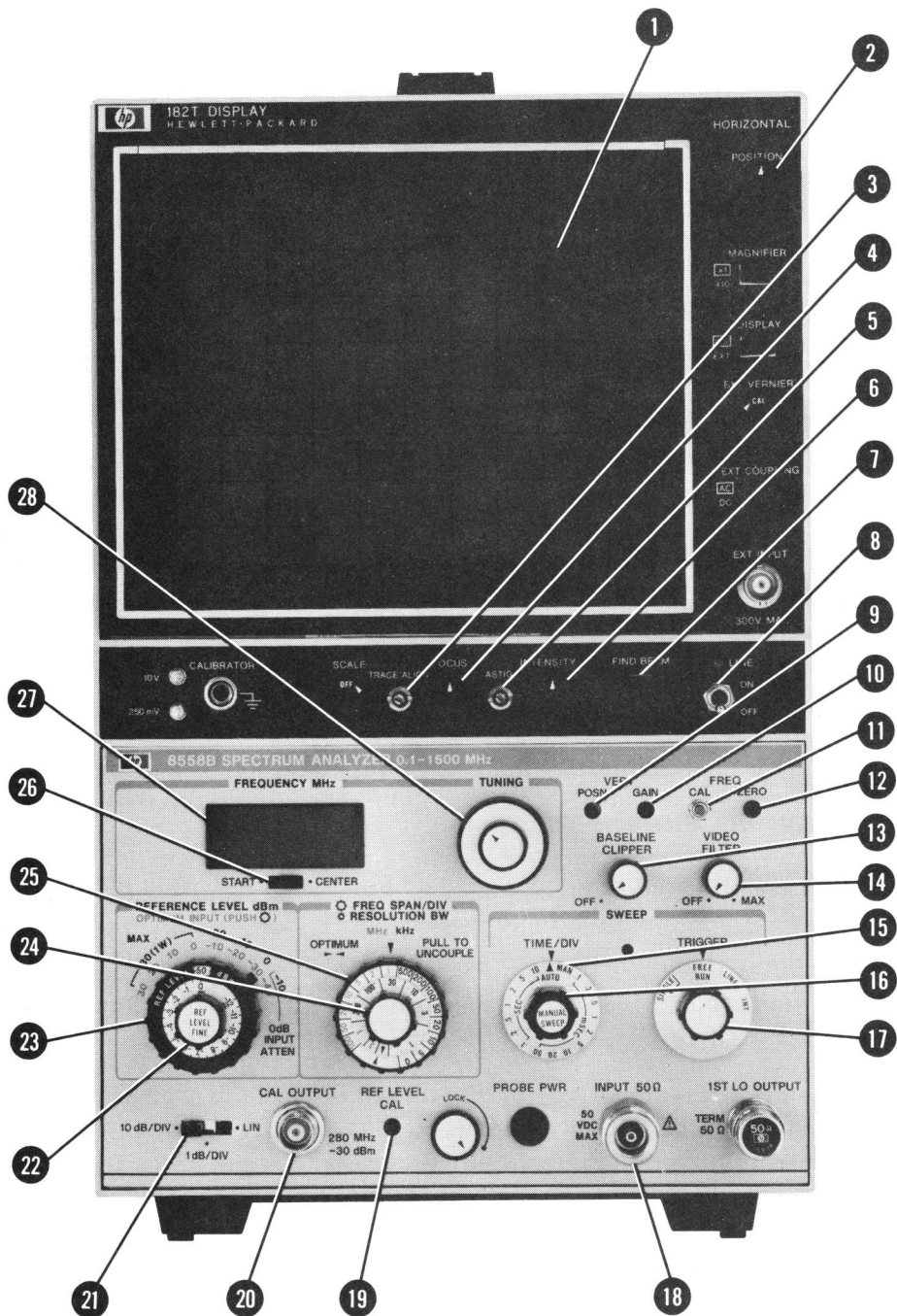


Figure 3-6. General Operating Procedure (1 of 2)

GENERAL OPERATING PROCEDURE

1. After 8558B Spectrum Analyzer has been calibrated to the oscilloscope mainframe, the 8558B becomes a three control instrument for most measurements.
2. The three controls, two for frequency and one for amplitude, control the frequency and amplitude displayed on the CRT. The TUNING control **28** and the FREQ SPAN/DIV control **25** coupled with the RESOLUTION BW control **24** determine the frequency displayed. The REFERENCE LEVEL dBm — OPTIMUM INPUT control **23** determines the amplitude displayed.

3. Controls should be preset as follows:

BASELINE CLIPPER **13** fully counterclockwise
 VIDEO FILTER **14** OFF
 SWEEP TIME/DIV **15** AUTO
 SWEEP TRIGGER **17** FREE RUN
 10 dB/DIV — 1 dB/DIV — LIN **21** 10 dB/DIV
 REF LEVEL FINE **22** fully counterclockwise
 START — CENTER **26** CENTER
 OPTIMUM INPUT **23** 0 dBm
 001: +5 dBm
 002: +55 dBmV

NOTE

With the SWEEP TIME/DIV control **15** in AUTO, the sweep time changes as FREQ SPAN/DIV **25**, RESOLUTION BW **24**, and VIDEO FILTER **14** are changed. When the SWEEP TIME/DIV control is removed from the AUTO position, care must be taken to not have sweep time too fast for Spectrum Analyzer response resulting in a loss of calibration.

CAUTION

To avoid mixer burnout (+13 dBm), Attenuator damage, or both, the RF signal to the INPUT 50Ω connector **18** should never exceed +30 dBm. 10 Vac peak, or ±50 Vdc.

002: Change "+13 dBm" to "+63 dBmV". Change "+30 dBm, 10 Vac peak, or ±50 Vdc" to "+80 dBmV or ±50 Vdc."
 001 and 002: 75Ω.

Connect unknown signal within the frequency range of 0.1 MHz to 1500 MHz.

5. Push in the REFERENCE LEVEL — OPTIMUM INPUT dBm control **23** and turn pointer to optimum input level for RF Input. If the level of RF Input is unknown, start with maximum input level setting (optimum input setting of +30 dBm) so the mixer will not be damaged. Release and turn the control so the signal amplitude is adequate for viewing.
 002: Change "+30 dBm" to "+80 dBmV".

6. Set the FREQ SPAN/DIV control **25** to 100 MHz. The RESOLUTION BW control **24** should be in optimum position 1 MHz. If not, uncouple and set to 1 MHz. Push in to couple.
7. Use TUNING control **28** (coarse and fine) to set FREQUENCY MHz **27** to 500 MHz. If the unknown signal is not displayed, move START—CENTER switch to START.
8. If unknown signal is still not displayed, reset OPTIMUM INPUT control and repeat step 7.
9. Move START—CENTER switch to CENTER and use TUNING control to tune signal of interest to center of display.
10. Use the REFERENCE LEVEL dBm — OPTIMUM INPUT control **23** to establish calibrated power level of top graticule reference line and amplitude of signal necessary to be viewed. Read power level of signal directly by adding power figure (dBm) displayed in window of REF LEVEL dBm to the difference between signal peak and top graticule reference line. Example: When -30 is displayed in REF LEVEL dBm window and signal peak is at graticule line four divisions from the top graticule line (reference of display), then

$$\begin{aligned}\text{signal power level} &= -30 \text{ dBm} + (-40 \text{ dB}) \\ &= -70 \text{ dBm}\end{aligned}$$

002: Example: When +20 is displayed in dBmV window and signal peak is at graticule line four divisions from top graticule line (reference of display), then:

$$\begin{aligned}\text{signal voltage level} &= +20 \text{ dBmV} + (-40 \text{ dBmV}) \\ &= -20 \text{ dBmV}.\end{aligned}$$

11. Set the FREQ SPAN/DIV control **25** coupled with the RESOLUTION BW control **24** to provide necessary spectrum detail.
12. Adjust the TUNING control **28** (coarse and fine) as necessary to keep signal of interest centered on CRT.
13. The FREQ SPAN/DIV control **25** and the RESOLUTION BW control **24** may be uncoupled at any time to provide added spectrum detail.

Figure 3-6. General Operating Procedure (2 of 2)

